A Decision-Support System for Warfarin Management: Follow-up Report.

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Background. *Warfarin* is a decision-support system (DSS), based on international consensus recommendations, that helps physicians optimize treatment of outpatients with an oral anticoagulant (warfarin). It is currently being used in Uruguay, and the initial results showed an impact on some of the clinical processes and outcomes [1]. They included data from the first 15 months of computerized follow-up (until February 1994), compared to a precomputer period of nine months. In this paper we report on the results regarding the next three years of continuous use of the program at the same site.

Analysis. The current analysis follows the same methodology as in the previous report. The laboratory results were converted to discrete values, dependent on whether the INR result, used to ascertain the level of anticoagulation, was within a certain range or not. Ranges included the actual goal of the subgroup analyzed (2.5 to 3.5), an extension of the goal +/- 0.5 (2.0 to 4.0), and an internationally accepted auditing range (2.0 to 4.5). Chi-square analysis was then performed, to compare these and the previously reported results.

Results and discussion. The administrative results for the complete population of patients are summarized in table 1. It is important to note : 1) the continuous increase in the number of patients actually seen each year, reaching 187 in the last year, which poses organizational challenges; 2) the more infrequent visits during the second year, corrected in the third (according to consensus recommendations); 3) the decreasing proportion of patients with a high therapeutic goal (INR of 2.5 to 3.5, necessary for mechanical heart valves). This fact indicates a greater variety of conditions leading to anticoagulation in this cohort.

The clinical results for the subgroup of patients with a high therapeutic goal (still the largest proportion in this population) are summarized in table 2. It is important to note the increase in the number of visits within auditing control limits (from 73.42% in the control period [1], and 73.70% and 74.65% in the previously reported computerized follow-up to over 79% in the last two years, $p = 0.015$). However, as in other series, it was difficult to have patients in the exact narrow range selected as a goal, and undertreated patients continued to be a problem. A tendency to temporal oscillations was also detected, with a poorer result in our Summer.

Table 1. Administrative data from the last 3 years.

	Mar 94 - Feb 95	Mar 95 - Feb 96	Mar 96 - Feb 97
# patients	147	158	187
# visits	1041	857	1308
Patients per visit day	11.1	10.2	14.2
Interval between visits	7.3 weeks	9.6 weeks	7.4 weeks
Patients with a higher goal	78.1 %	77.4 %	69.0 %

Table 2. Percentages of visits spent in various INR bands. *Higher therapeutic goal only* (2.5 to 3.5).

	Mar 94 - Feb 95	Mar 95 - Feb 96	Mar 96 - Feb 97
2.5 - 3.5	38.1%	42.0%	43.2%
2.0 - 4.0	72.0%	74.4%	74.9%
2.0 - 4.5	76.3%	79.3%	79.4%
< 2	19.8%	16.1%	16.6%
> 4.5	3.8%	4.4%	4.0%
Missing INR	0.12%	0.15%	0%
# of visits	819	657	934

Future trends. The long-term overall results of anticoagulating a large population of patients with the help of a DSS are encouraging. Challenges include a wider dissemination of the use of the system, a more rigorous experimental evaluation with a concurrent control group, more frequent and thorough descriptive analysis and feedback, and program upgrade on both the clinical and computer aspects.

References

1. Margolis A, Flores F, Kierszenbaum M, et al. *Warfarin 2.0* - A computer program for Warfarin management. Design and clinical use. Proc Annu Symp Comput Appl Med Care 1994 ; 18 :846-50.

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